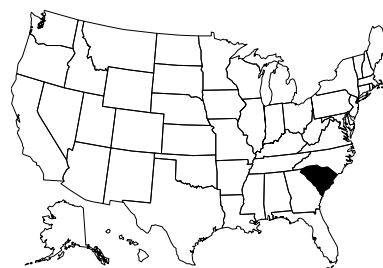


SOUTH CAROLINA

Contact Information

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Program Description

Biologists at the South Carolina Department of Health and Environmental Control use aquatic macroinvertebrates as bioindicators to make assessments of water quality. The program began in the early 1970s with the first technical report printed in 1972. Currently, flowing streams and rivers are the primary waterbodies that are assessed. South Carolina's monitoring efforts can be divided into two categories: ambient monitoring and special studies. Both fixed sites and randomly selected sites are chosen each year for the ambient monitoring work. Fixed sites are sampled once every five years on a rotating basin schedule. Special studies usually involve a point source discharge or a nonpoint source perturbation such as a logging operation. Upstream and downstream sites are selected for sampling when conducting special studies. Agency staff may carry out the special studies or they may be required by the industry as part of a permit or consent order. In the latter case, state certified consultants conduct the studies with the resulting reports reviewed by agency scientists.

South Carolina's program is modeled after that of North Carolina's, which was developed in the 1970s and 1980s. A timed qualitative multihabitat approach is taken for sampling macroinvertebrates. Organisms are picked in the field and returned to the laboratory for identification to the lowest practical taxonomic level – usually genus or species. Two metrics are calculated to produce an assessment: the EPT Index, and the NC Biotic Index. These two metrics are standardized on a scale of 1 to 5 and averaged to produce a final score. The Bioclassification of the stream is based on this score. The numeric criteria developed in SC are dependant on the ecoregion within which the stream is located. There are separate criteria for the mountains, piedmont, and coastal plain regions of the state. For special studies, impact is determined by the change in the bioclassification score from the upstream control site to the downstream test site. A rigorous quality control/quality assurance program has been developed and implemented for sampling, identification of organisms, and data entry.

Documentation and Further Information

The 2002 Section 305(b) Water Quality Assessment Report for South Carolina, March 2000:
<http://www.scdhec.net/eqc/water/pubs/305b.pdf>

State of South Carolina 303(d) List for 2000, EPA approved in May 2000:
<http://www.scdhec.net/eqc/water/pubs/303d2000.pdf> (for the DRAFT 2002 303(d) List and 1998 303(d) List, go to <http://www.scdhec.net/eqc/water/html/tmdl.html#303d>)

The Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. 2001. SC DHEC.

State of South Carolina Monitoring Strategy for Calendar Year 2002, January 2002:
<http://www.scdhec.net/eqc/water/pubs/strategy.pdf>

Antidegradation Implementation for Water Quality in South Carolina, July 1998:
<http://www.scdhec.net/eqc/water/pubs/antideg.pdf>

Watershed Water Quality Management Strategy Program Description:
<http://www.scdhec.net/water/shed/prog.html>

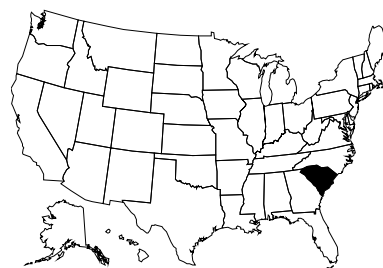
For a list of and links to additional SC DHEC Bureau of Water water quality publications, go to
<http://www.scdhec.net/eqc/admin/html/eqcpubs.html#wqreports>

DRAFT July 1998. *Standard Operating Procedures and Quality Control Procedures for Macroinvertebrate Sampling*. Technical Report No. 004-98. Prepared by South Carolina Bureau of Water, Division of Water Monitoring, Assessment and Protection, Aquatic Biology Section.

SOUTH CAROLINA

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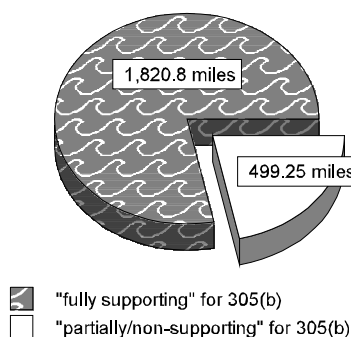
Programmatic Elements

Uses of bioassessment within overall water quality program	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
Applicable monitoring designs	<input type="checkbox"/>	other:
	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) (<i>comprehensive use throughout jurisdiction</i>)
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) (<i>comprehensive use throughout jurisdiction</i>)
	<input checked="" type="checkbox"/>	probabilistic by stream order/catchment area (<i>comprehensive use throughout jurisdiction</i>)
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide (<i>comprehensive use throughout jurisdiction</i>)
	<input checked="" type="checkbox"/>	rotating basin (<i>specific river basins or watersheds</i>)
	<input type="checkbox"/>	other:

Stream Miles

Total miles (determined using RF3)	35,461
Total perennial miles	25,729
Total miles assessed for biology*	2,320
fully supporting for 305(b)	1,820.8
partially/non-supporting for 305(b)	499.25
listed for 303(d)	499.25
number of sites sampled (on an annual basis)	80
number of miles assessed per site	—

2,320 Miles Assessed for Biology



*These miles, listed in the 2000 205(b) report, were assessed based on a combination of physical/chemical **and** biological/habitat data. The following subset of the 2,320 total combined miles contains stream miles assessed based **solely** on biological/habitat: 678.6 total miles assessed, 563.98 miles "fully supporting" for 305(b), and 114.6 miles "partially/non-supporting" for 305(b) and listed for 303(d).

Aquatic Life Use (ALU) Designations and Decision-Making

ALU designation basis	Class System (A,B,C) and Warm Water vs. Cold Water
ALU designations in state water quality standards	Three designations: Freshwater, Trout - 3 types, Saltwater
Narrative Biocriteria in WQS	Procedures used to support narrative biocriteria are not included in SC water quality standards, but are available in the monitoring program SOP.
Numeric Biocriteria in WQS	none (South Carolina has limited numeric biocriteria/indices used to evaluate ALU, which are not included in state water quality standards – see monitoring program SOP.)
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/> assessment of aquatic resources <input checked="" type="checkbox"/> cause and effect determinations <input checked="" type="checkbox"/> permitted discharges <input checked="" type="checkbox"/> monitoring (e.g., improvements after mitigation) <input checked="" type="checkbox"/> watershed based management
Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	Biocriteria can affect permitting decisions if a watershed is listed on the 303(d) list for biological impacts.

Reference Site/Condition Development

Number of reference sites	30 total
Reference site determinations	<input type="checkbox"/> site-specific <input type="checkbox"/> paired watersheds <input checked="" type="checkbox"/> regional (aggregate of sites) <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
Reference site criteria	The best sites are selected from a habitat and organismal point of view. Faunal characteristics and land use data from GIS are also considered (see newly-amended R.61-68.F.I.d. for more information).
Characterization of reference sites within a regional context	<input type="checkbox"/> historical conditions <input checked="" type="checkbox"/> least disturbed sites <input type="checkbox"/> gradient response <input type="checkbox"/> professional judgment <input type="checkbox"/> other:
Stream stratification within regional reference conditions	<input checked="" type="checkbox"/> ecoregions (or some aggregate) <input type="checkbox"/> elevation <input checked="" type="checkbox"/> stream type <input type="checkbox"/> multivariate grouping <input type="checkbox"/> jurisdictional (i.e., statewide) <input type="checkbox"/> other:
Additional information	<input checked="" type="checkbox"/> reference sites linked to ALU <input checked="" type="checkbox"/> reference sites/condition referenced in water quality standards (found in R61-68.F.I.d.) <input checked="" type="checkbox"/> some reference sites represent acceptable human-induced conditions

Field and Lab Methods

Assemblages assessed	<input checked="" type="checkbox"/>	benthos (<i>100-500 samples/year; multiple seasons, multiple sites – broad coverage for watershed level</i>)
	<input type="checkbox"/>	fish
	<input type="checkbox"/>	periphyton
	<input type="checkbox"/>	other:
Benthos		
sampling gear		collect by hand, brass sieve, D-frame, kick net (1 meter); 500-600 micron mesh
habitat selection		multihabitat
subsample size		entire sample
taxonomy		combination and species when possible
Habitat assessments		visual based; performed with bioassessments
Quality assurance program elements		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, taxonomic and sampling proficiency checks, specimen archival, data entry checks, certification program for bioassessment

Data Analysis and Interpretation

Data analysis tools and methods	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics (<i>aggregate metrics into an index</i>)
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
Multimetric thresholds		
transforming metrics into unitless scores		cumulative distribution function
defining impairment in a multimetric index		cumulative distribution function - follow guidelines outlined in following document: Lenat. 1993. <i>A biotic index for the southeastern United States, derivation and list of tolerance values, with criteria for assigning water quality ratings</i> . Journal of the North American Benthological Society. 12:279-290
Evaluation of performance characteristics	<input type="checkbox"/>	repeat sampling
	<input checked="" type="checkbox"/>	precision (<i>replicate sampling of same stream, 10% each year</i>)
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input checked="" type="checkbox"/>	accuracy (<i>compare faunal results with land use data and discharge presence or absence</i>)
Biological data		
Storage		MS FoxPro for Windows and Excel
Retrieval and analysis		FoxPro